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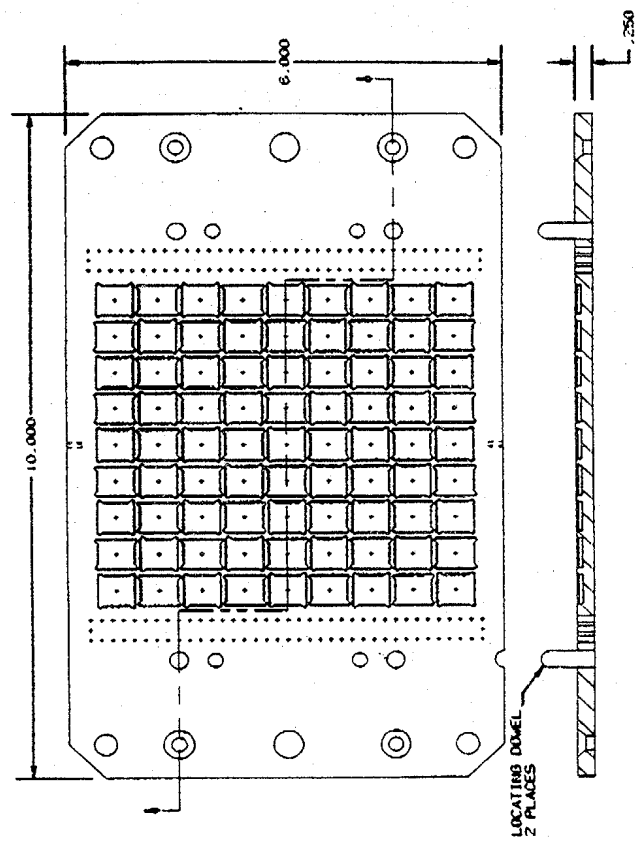


Figure 1 - Typical boat design for the low volume ball attach method.

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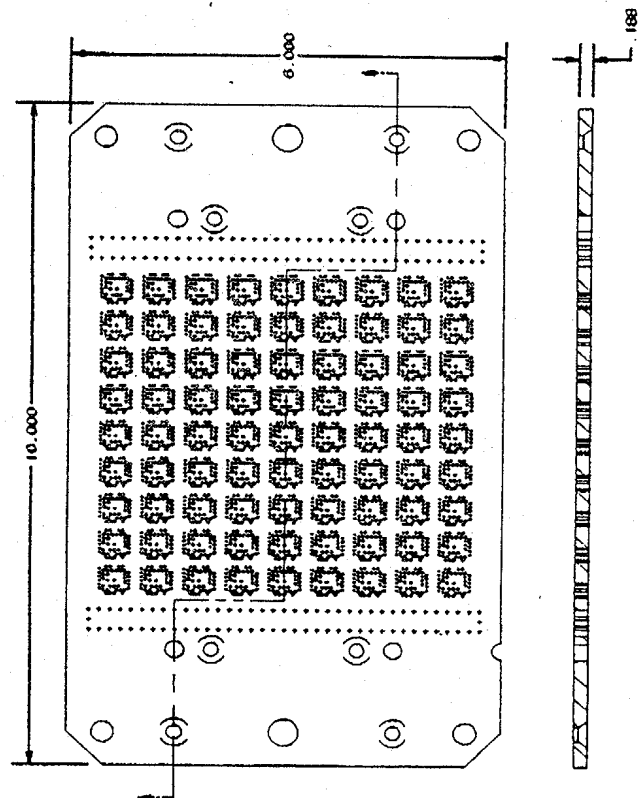


Figure 2 - Typical alignment plate design for the boat shown in Figure 1.

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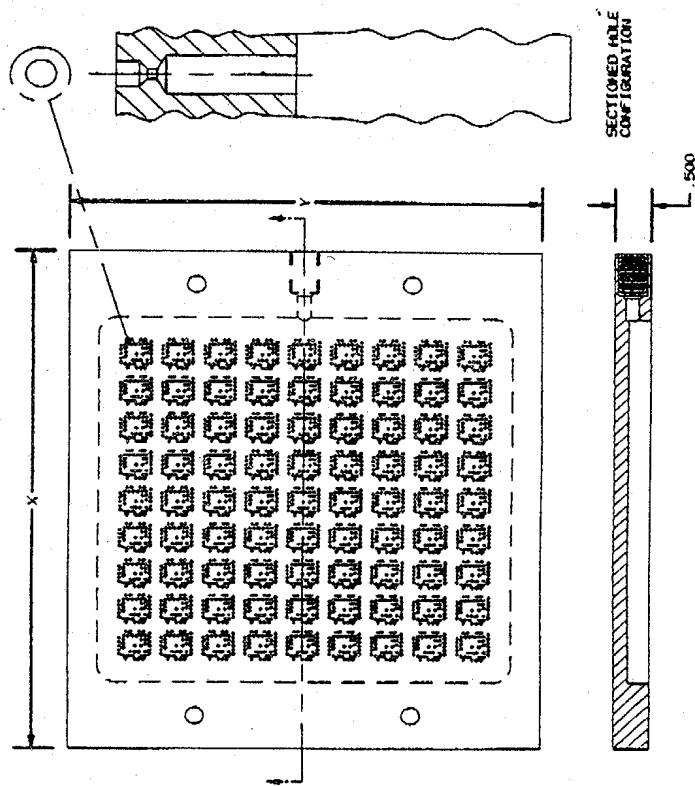


Figure 3 - Typical vacuum loader plate design for the hole pattern shown in Figures 1 & 2. The x and y dimensions are a function of the boat design (low volume method) or the carrier design (high volume method) as applicable.

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HR 0	MIN 0	SEC 1	VAC ON
HR 0	MIN 0	SEC 40	VAC OFF
HR 0	MIN 0	SEC 42	GAS 2 ON
HR 0	MIN 0	SEC 50	GAS 2 OFF (To ~10 psig)
HR 0	MIN 0	SEC 52	EXH ON
HR 0	MIN 0	SEC 56	EXH OFF
HR 0	MIN 0	SEC 58	VAC ON
HR 0	MIN 1	SEC 0	HEAT ON
HR 0	MIN 1	SEC 30	160
HR 0	MIN 4	SEC 30	160
HR 0	MIN 4	SEC 32	VAC OFF
HR 0	MIN 4	SEC 34	GAS 2 ON
HR 0	MIN 4	SEC 38	GAS 2 OFF (To 1-4 psig)
HR 0	MIN 5	SEC 0	225
HR 0	MIN 7	SEC 0	225
HR 0	MIN 7	SEC 1	HEAT OFF
HR 0	MIN 7	SEC 30	EXH ON
HR 0	MIN 7	SEC 34	GAS 3 ON
HR 0	MIN 7	SEC 58	GAS 3 OFF
HR 0	MIN 8	SEC 0	EXH OFF

Figure 4 - Typical ball attach soldering profile for 63Sn/37Pb solder material. The temperatures shown in the right hand column are expressed in degrees Centigrade. Gas 2 is 10% hydrogen - 90% nitrogen forming gas pressurized to the indicated gauge pressure values. Gas 3 is dry nitrogen. Dwell time at the 225°C soldering temperature is shown to be two minutes.

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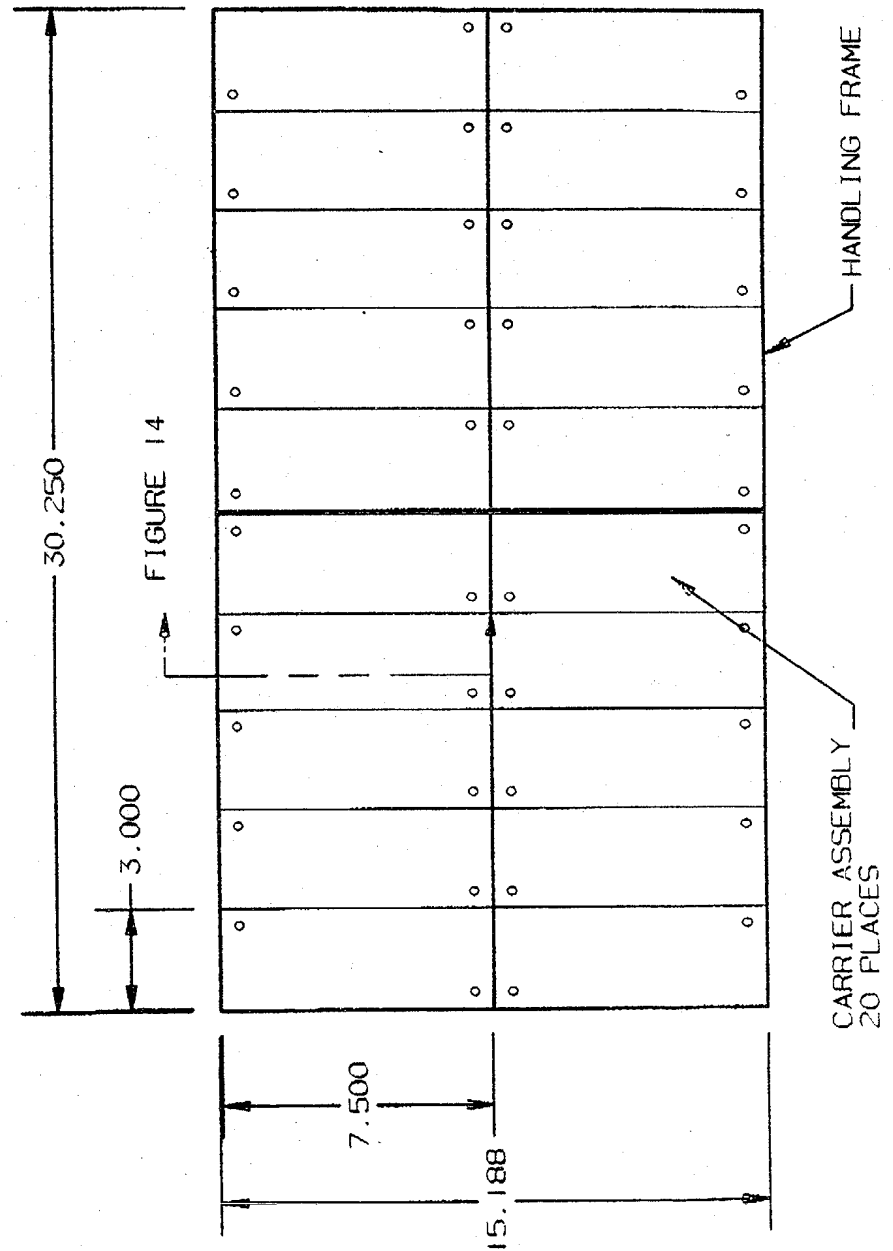


Figure 5 - Two fully loaded holding frames positioned end to end. Each frame is shown to contain a total of 10 carrier assemblies configured in two adjacent rows of five assemblies each.

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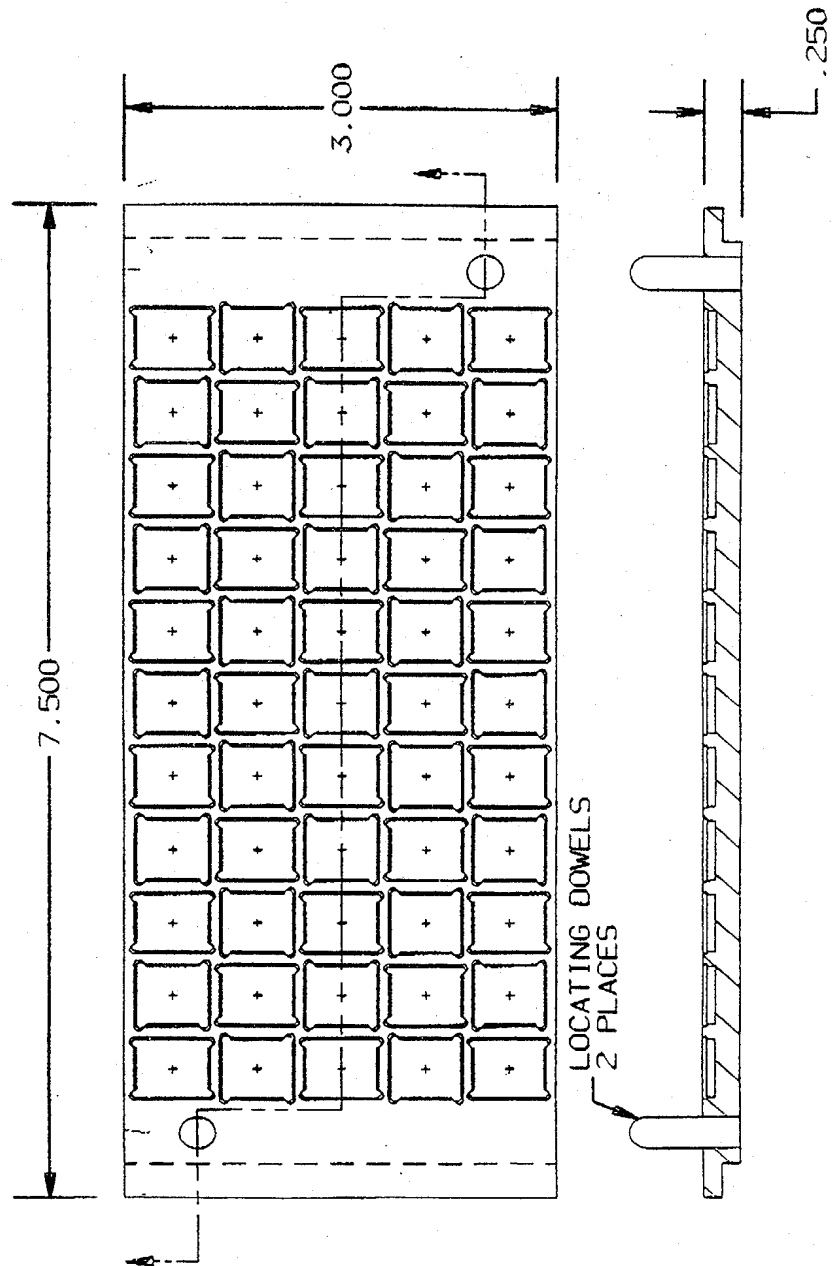


Figure 6 - Typical carrier plate design for the high volume method of ball attach.

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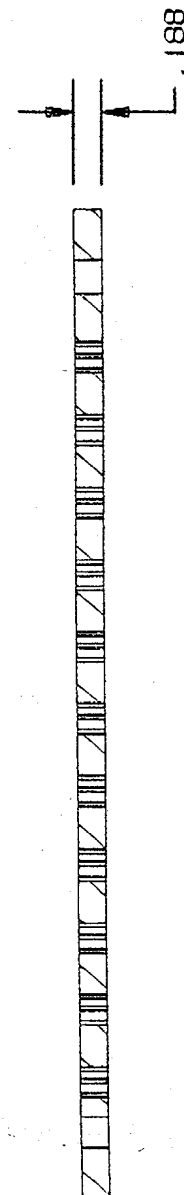
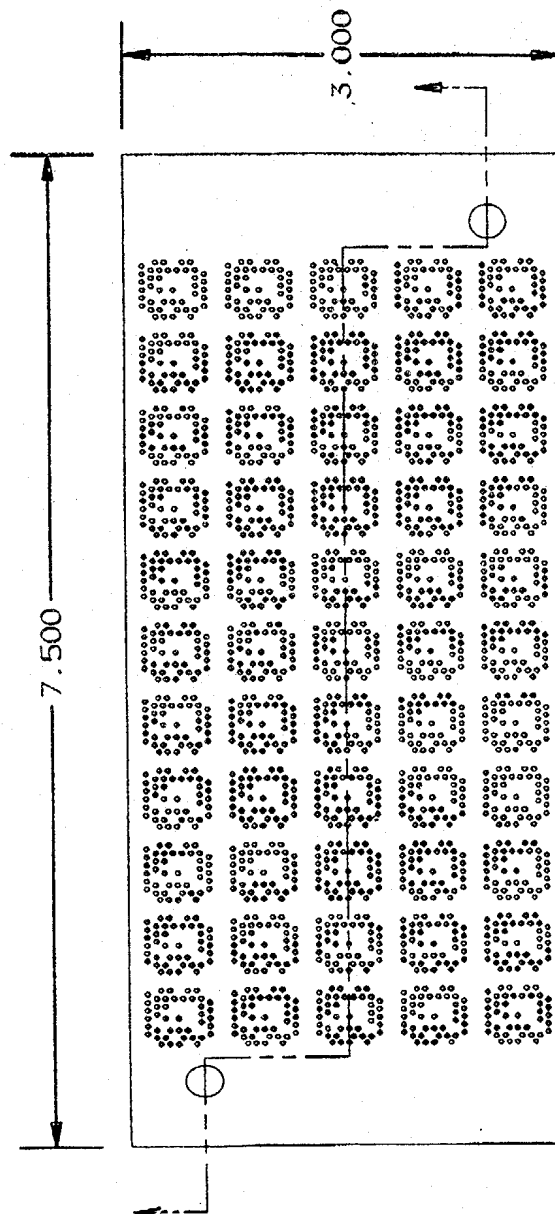


Figure 7 - Typical alignment plate design for the high volume ball attach method. The mating carrier plate is shown in Figure 6.

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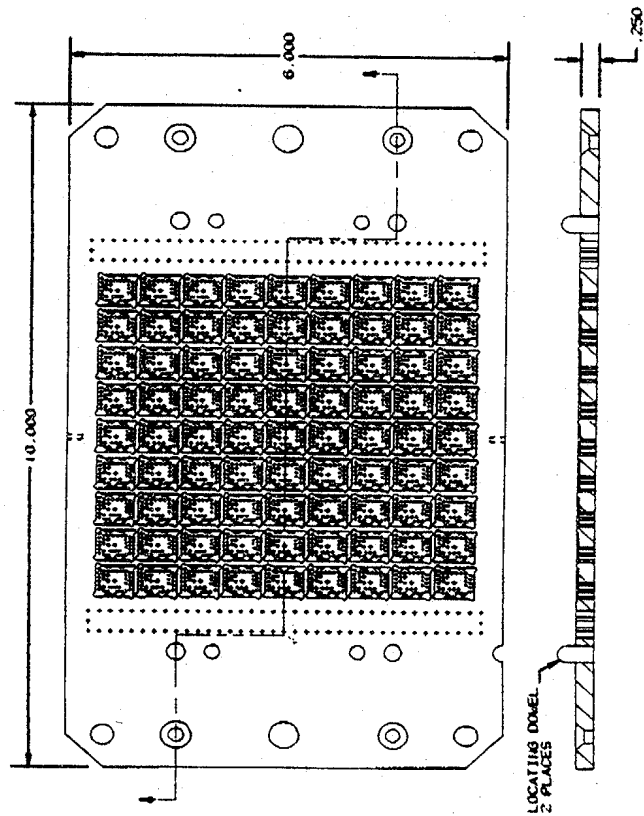


Figure 8 - Typical multipurpose boat design for ceramic BGA packages. The boat is used for the low volume method of die attach, lid seal and ball attach.

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HR 0	MIN 0	SEC 1	VAC ON	
HR 0	MIN 0	SEC 40	VAC OFF	
HR 0	MIN 0	SEC 42	GAS 2 ON	
HR 0	MIN 0	SEC 50	GAS 2 OFF	(To -10 psig)
HR 0	MIN 0	SEC 52	EXH ON	
HR 0	MIN 0	SEC 56	EXH OFF	
HR 0	MIN 0	SEC 58	VAC ON	
HR 0	MIN 1	SEC 0	HEAT ON	
HR 0	MIN 2	SEC 0	240	
HR 0	MIN 4	SEC 0	240	
HR 0	MIN 4	SEC 2	VAC OFF	
HR 0	MIN 4	SEC 4	GAS 2 ON	
HR 0	MIN 4	SEC 5	GAS 2 OFF	
HR 0	MIN 4	SEC 30	325	
HR 0	MIN 4	SEC 45	GAS 2 ON	(Backfill to
HR 0	MIN 4	SEC 55	GAS 2 OFF	-30 psig for
HR 0	MIN 5	SEC 0	325	attach)
HR 0	MIN 5	SEC 1	HEAT OFF	
HR 0	MIN 5	SEC 30	EXH ON	
HR 0	MIN 5	SEC 34	GAS 3 ON	
HR 0	MIN 6	SEC 58	GAS 3 OFF	
HR 0	MIN 7	SEC 0	EXH OFF	

Figure 9 - Typical die attach soldering profile for 80Au/20Sn solder material. The temperatures shown in the right hand column are expressed in degrees Centigrade. Gas 2 is 10% hydrogen - 90% nitrogen forming gas pressurized to the indicated gauge pressure values. Gas 3 is dry nitrogen. Dwell time at the soldering temperature of 325° is shown to be 30 seconds.

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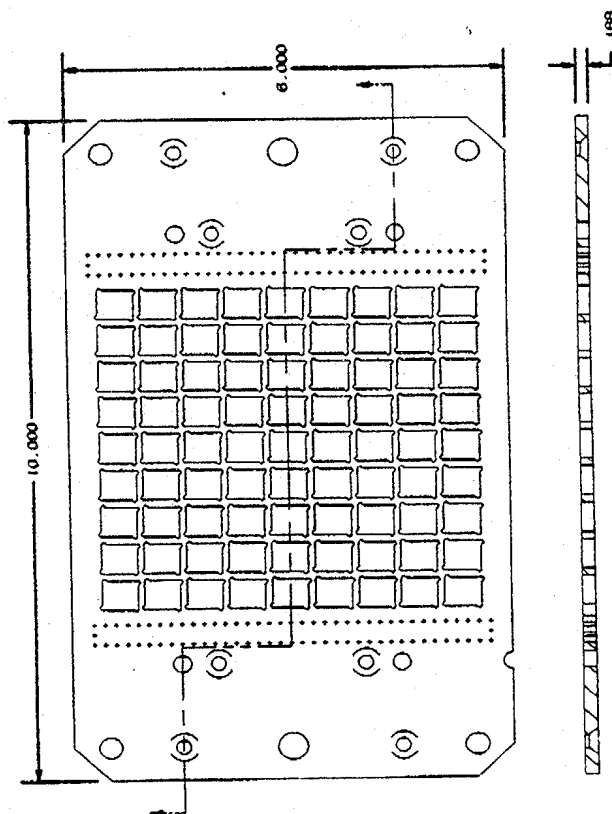


Figure 10 - Typical multipurpose heat plate design for the low volume method of lid seal and ball attach. The mating boat is shown in Figure 8.

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HR 0	MIN 0	SEC 1	VAC ON
HR 0	MIN 0	SEC 40	VAC OFF
HR 0	MIN 0	SEC 42	GAS 2 ON
HR 0	MIN 0	SEC 50	GAS 2 OFF (To ~ 10 psig)
HR 0	MIN 0	SEC 52	EXH ON
HR 0	MIN 0	SEC 56	EXH OFF
HR 0	MIN 0	SEC 58	VAC ON
HR 0	MIN 1	SEC 0	HEAT ON
HR 0	MIN 2	SEC 0	240
HR 0	MIN 4	SEC 0	240
HR 0	MIN 4	SEC 2	VAC OFF
HR 0	MIN 4	SEC 4	GAS 2 ON
HR 0	MIN 4	SEC 8	GAS 2 OFF (To 1-4 psig)
HR 0	MIN 4	SEC 30	325
HR 0	MIN 6	SEC 30	325
HR 0	MIN 6	SEC 31	HEAT OFF
HR 0	MIN 7	SEC 0	EXH ON
HR 0	MIN 7	SEC 4	GAS 3 ON
HR 0	MIN 8	SEC 58	GAS 3 OFF
HR 0	MIN 9	SEC 0	EXH OFF

Figure 11 - Typical lid seal soldering profile for 80Au/20Sn solder material. The temperatures shown in the right hand column are expressed in degrees Centigrade. Gas 2 is dry nitrogen pressurized to the indicated gauge pressure values. Gas 2 is the gaseous atmosphere that is trapped inside the package during the sealing operation. Gas 3 is also dry nitrogen. Dwell time at the 325°C soldering temperature is shown to be two minutes.

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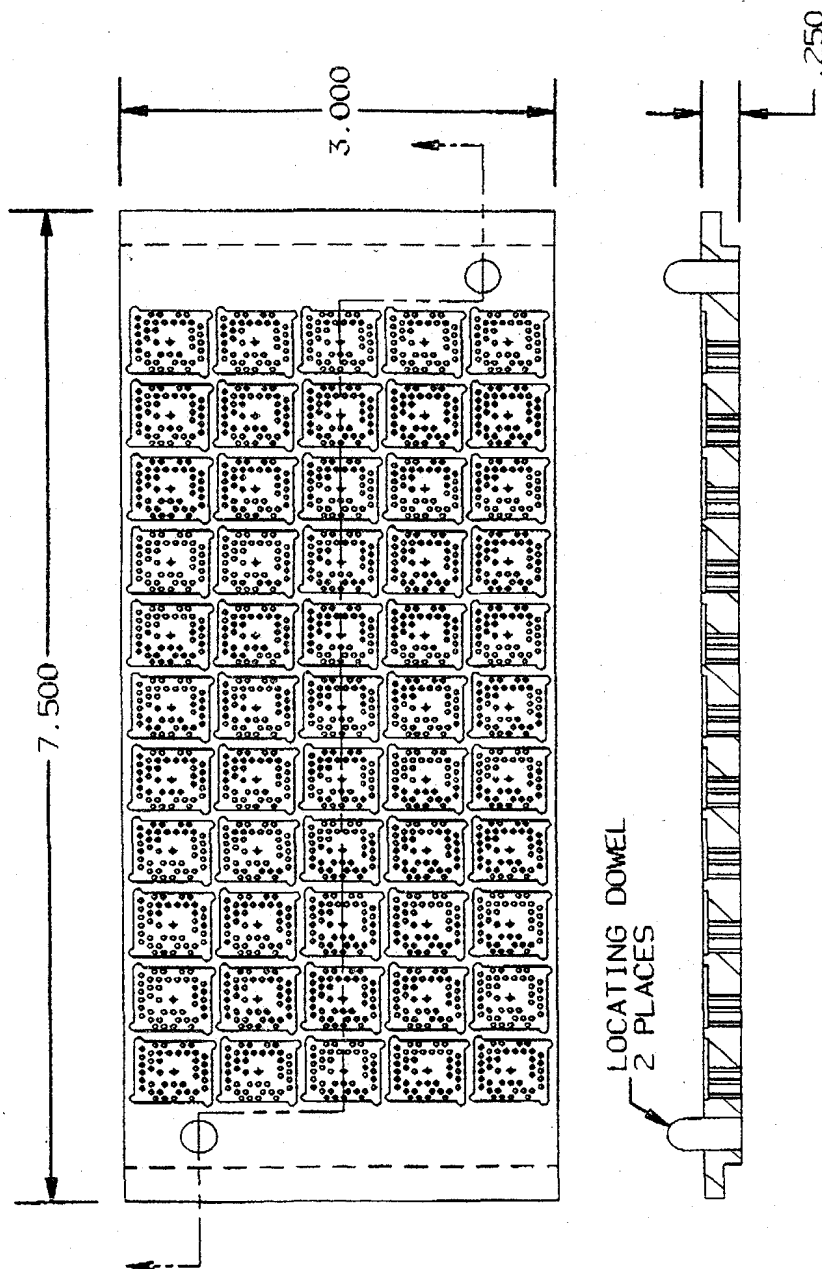


Figure 12 - Typical multipurpose carrier plate design for ceramic BGA packages. The carrier plate is used for the high volume method of die attach, lid seal and ball attach.

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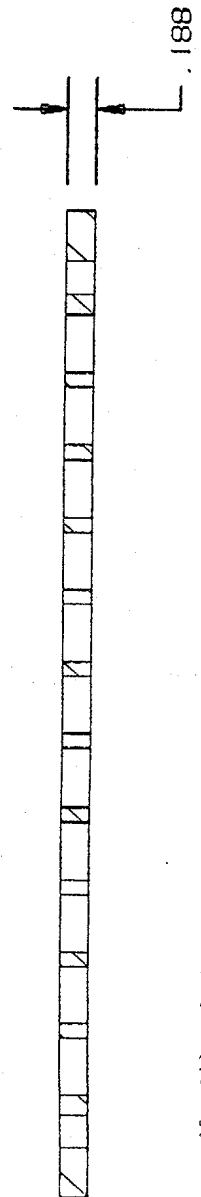
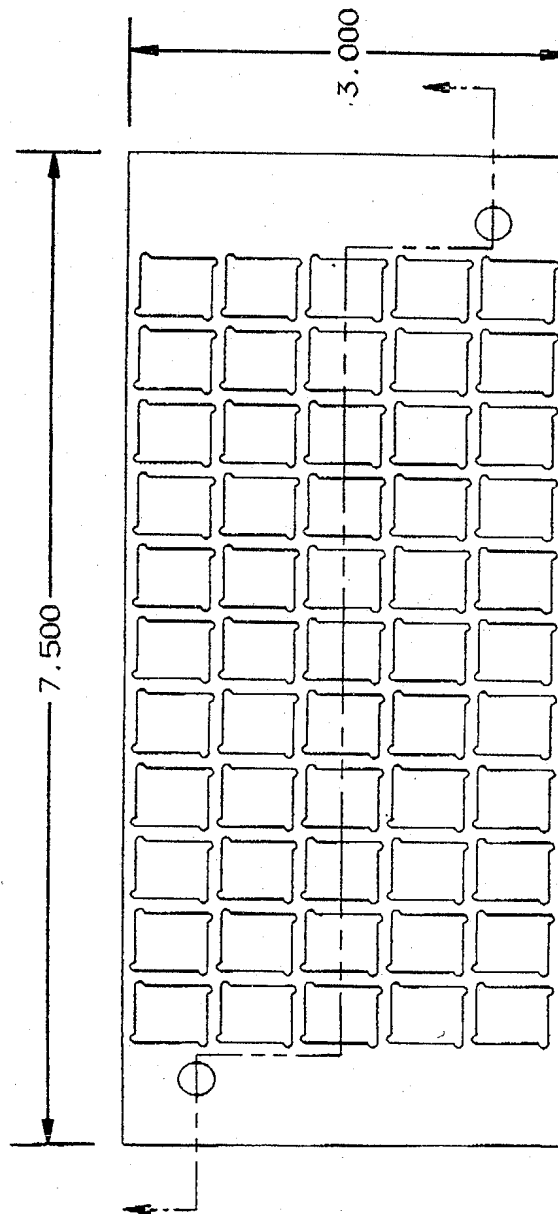


Figure 13 - Lid seal plate design for ceramic BGA packages. The lid seal plate is used for the high volume method of die attach, lid seal and ball attach. The mating carrier plate is shown in Figure 12.

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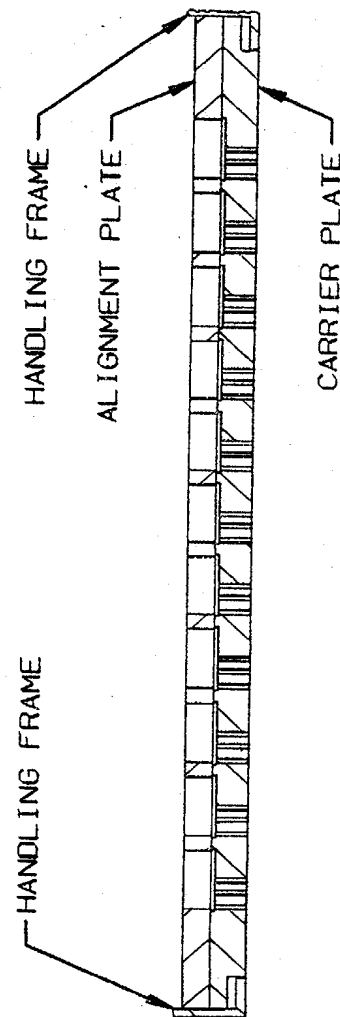
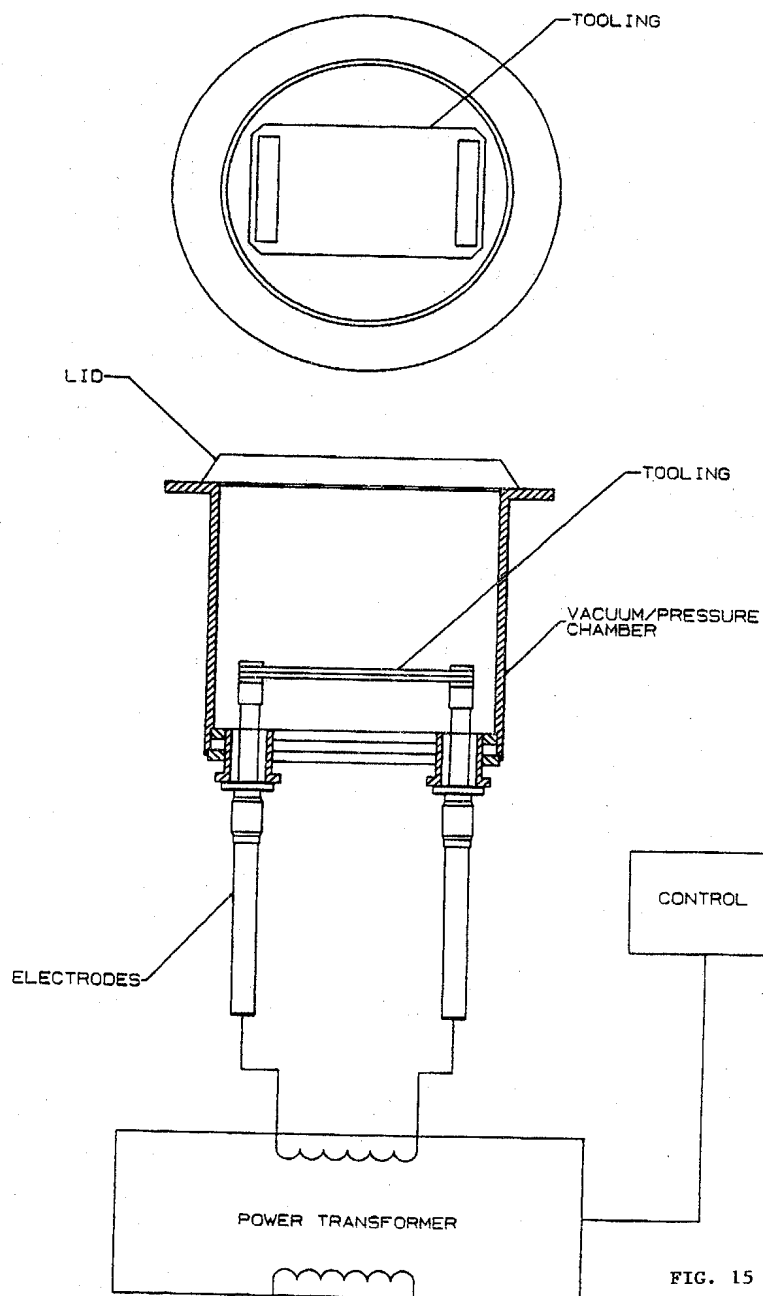


Figure 14 - Handling frame that is fully loaded with multipurpose carrier assemblies and cross sectioned in the plane referenced in Figure 5.

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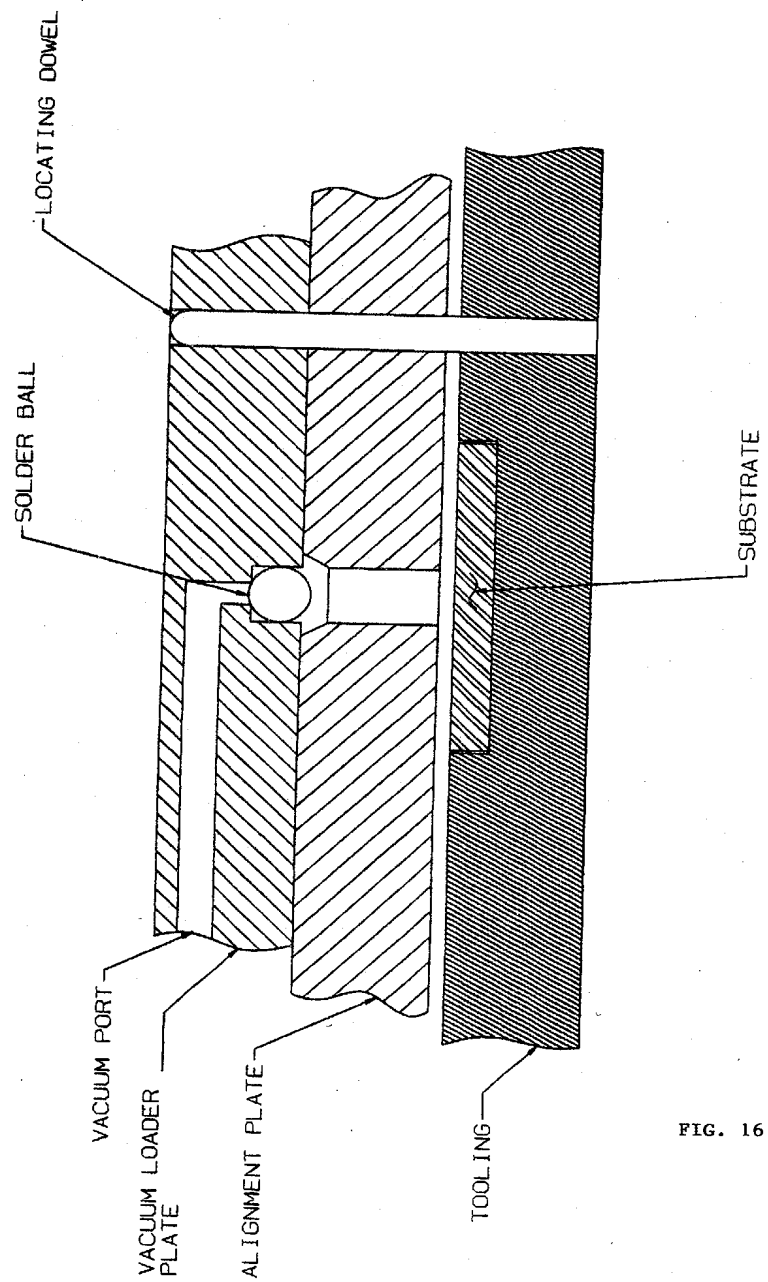


FIG. 16

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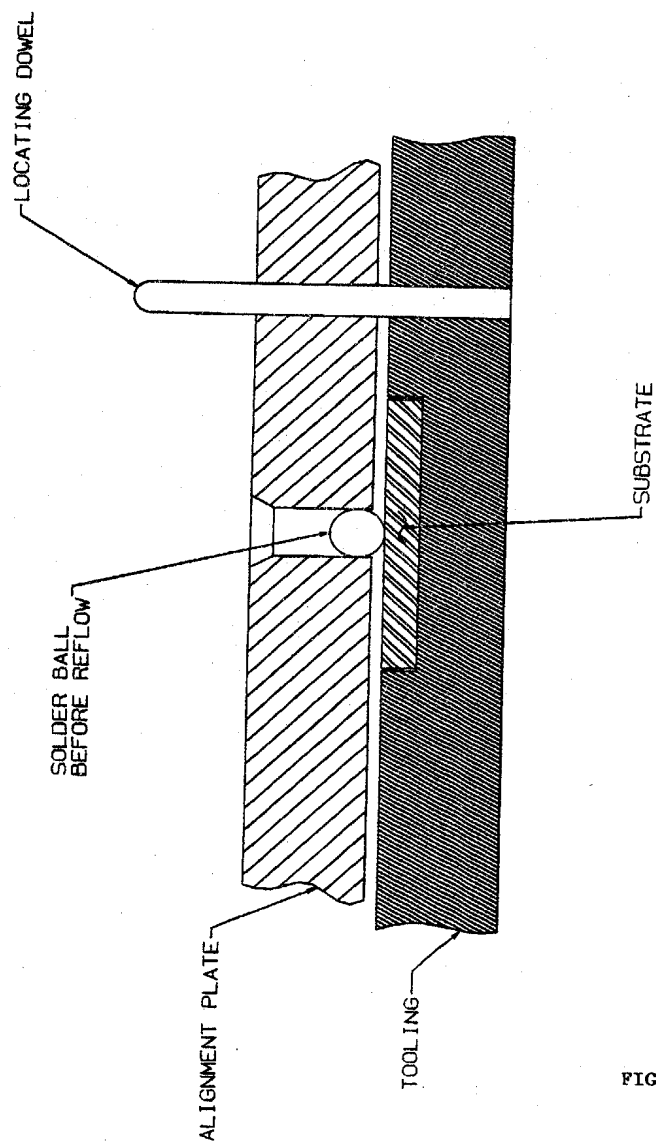


FIG. 17

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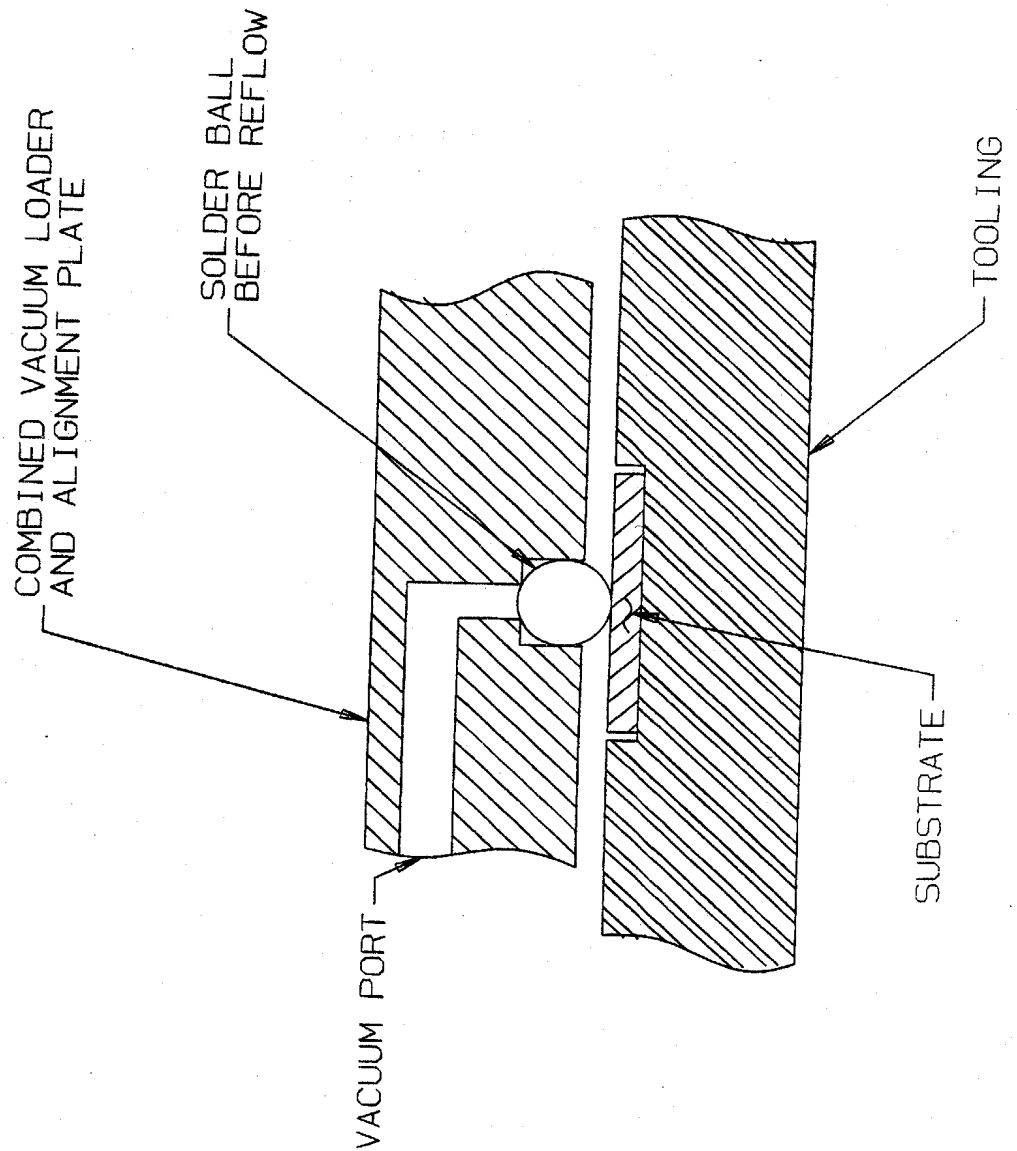


FIG. 18

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SOLDER BALL
AFTER REFLOW

SUBSTRATE

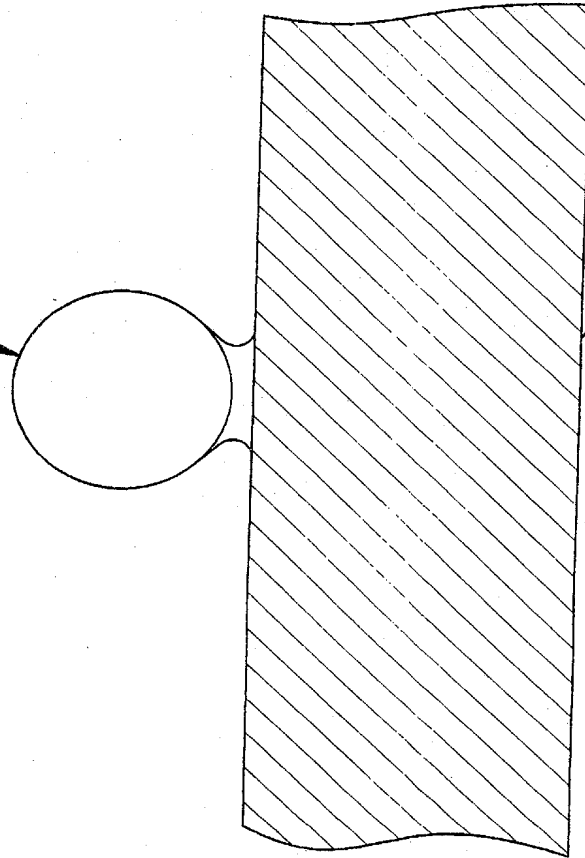


FIG. 19